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SOUTHWESTERN JOURNAL OF ANTHROPOLOGY

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THE CURRENT ISSUE WAS EDITED BY
LESLIE SPIER

THE UNIVERSITY OF NEW MEXICO
ALBUQUERQUE

[Title Page]

BLOOD GROUP ANTIGEN TESTS OF THE WAICA INDIANS OF VENEZUELA.[1]

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GENERAL ANTHROPOLOGICAL INFORMATION

128 INTRODUCTION: For the purpose of the present paper we would like to classify the Waica as a subtribe of the Yanoama tribe, the ethnic identification and the internal composition of which appears to be but little understood. Although the actual blood group study will be concerned with the Waica Indians most particularly, we shall, nevertheless, include as well some information on the Yanoama tribe in general. This, we trust, will not only serve to locate the specific Waica data within a wider frame of reference, but also to facilitate the comprehension of the theoretical considerations based thereon.

131 *Ethnic identification.* The Yanoama inhabit a very extensive area between 0°30'-5° N and 62°-65° W, which includes the headwaters of the Paragua, Caura, Ventuari, Padamo, Ocamo, Mavaca, and Orinoco rivers of Venezuela, as well as those of the Uraricuera, Catrimani, Dimini, and Aratá rivers of Brazil. The Sierra Parima crosses this heavily forested territory like a vertebral column, so to speak, and marks at the same time the frontier between the Venezuelan and the Brazilian parts of the Yanoama land (see map, Fig. 1).

101 The Yanoama are surrounded by Tropical Forest Indians with Neo-Indian culture types; Cariban tribes enclose them in a semi-circle to the northeast, while Arawakan peoples bound them in a semicircle to the southwest. Thus, the Yanoama seem to have been functioning as a buffer between the Caribs and the Arawak, [648] successfully resisting any attempt of intrusion by such groups as the Soto (Makiritare), the Pemon, and others. In recent years, after their Carib neighbours had suffered a marked decline in numbers and in strength, the Yanoama ventured northward into the Ventuari, Caura, and Paragua drainage area, intruding into Carib territory for more than 100 km.

114 Although sporadic and rather casual information on the several Yanoama groups have been published by various authors since early Colonial time, it is only

122 1 We wish to thank Dr A. Berti and Ovidio Castellani (División de Malariología, Ministerio de Sanidad, Venezuela) and the Misión Salesiana of the Territorio Federal Amazonas for their collaboration in collecting the blood samples. We are also indebted to Esperanza García for her technical assistance. We are greatly indebted to J. P. O'Riordan (The National Blood Transfusion Association, Dublin), M. Shapiro (The South African Blood Transfusion Service, Johannesburg), R. E. Rosenfield (The Mount Sinai Hospital, New York), and Albin Moore (The Minneapolis Memorial Blood Bank, Minnesota) for supplying us with critical anti-sera.

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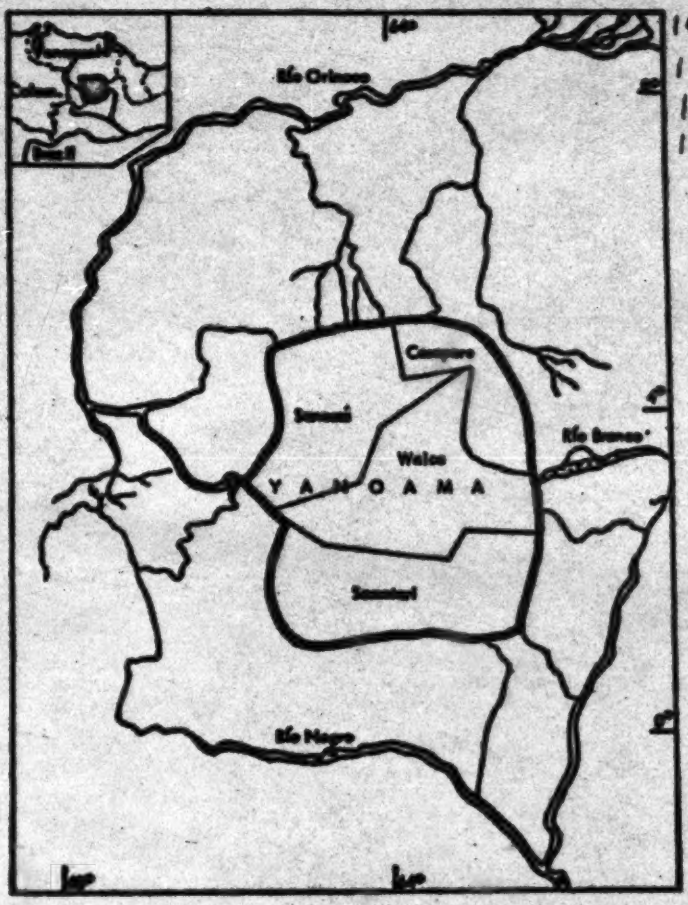

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FIG. 1. Preliminary map of Yanoama distribution. (Wilbert, 1961b).

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since Koch-Grünberg's contact with two Yanoama groups, in 1911, that more substantial information on this interesting tribe has been collected and in parts been published.[2]

Emerging from these data are the names and descriptions of a number of distinguishable tribal units, e.g., Sanemá (Guaharibo, Shirishana), Casapare, Waica, Samatari, Surara, Pakidái, and others. It also has become quite obvious that the Yanoama subtribes are not unified by socio-political authority, but rather by a general and specific culture type, which in turn is integrated by a series of subcultures and culture variants, carried by the different subtribes and local groups respectively. The various local groups and subtribes occupy a coherent territory, they speak more or less closely related languages and display essentially similar economic, sociological, and religious forms.

Taken as a whole, the Yanoama were found to be a very numerous tribe and they belong, in fact, to the most numerous of all the autochtonous populations of lowland South America, but previously published figures of 30-50,000 individuals appear to represent very generous overestimations of the demographic strength of the Yanoama groups known so far.

Linguistic classification. Several authors have attempted a linguistic classification of the Yanoama although most of them did not have at their disposal the more recent material.[3] Taking advantage of this material, we have attempted a glottochronological analysis, the results of which allow us some interesting insight into the internal correlation of the Yanoama languages.[4]

According to this result, the several Yanoama languages, as known today, constitute the Yanoama linguistic stock of 6-35 mc of internal separation. The two more or less clearly distinguishable families of the stock are: *A. Sanemá:* (a) Sanemá, (b) Nabudíb, (c) Pubunatari, [6-17 mc of internal divergencies: Sanemá-Nabudíb = 6 mc, Sanemá-Pubunatari = 17 mc, Nabudíb-Pubunatari = 17 mc]; *B. Casapare:* (a) Casapare, (b) Carime (?), (c) Waica, (d) Sanatari (Surara and Pakidái), [8-21 mc of internal divergencies, excepting Carime (for lack of vocabulary material): Casapare-Waica = 21 mc, Casapare-Sanatari = 21 mc, Waica-Sanatari = 8 mc].

2 Sanema-Pakidái, by Becher, 1960; Waica, by Becher, 1953; Schauer, 1958; Zerries, 1955, 1956, 1958a, 1958b, 1959, 1960; Sanemá, by Vinci, 1959; Wilbert, 1961a, 1961b.

3 Rivet, 1924, p. 678; Loukotka, 1944, pp. 8-9; Mason, 1950, p. 234; Rivet and Loukotka, 1952, p. 1140; McQuown, 1955, p. 525; Greenberg, 1956; Swadesh, 1959, p. 20; Dall' Igna Rodrigues, 1958, pp. 136-137.

4 We are indebted to Dra H. Becher and O. Zerries for having us have a basic vocabulary of Sanema-Pakidái and Waica respectively. Complete information on source material has been presented by Wilbert, 1961a.

In 1913, Koch-Grünberg[5] had observed that Yanoaman was different from Cariban and that it apparently represented an isolated language. While this opinion was shared by the majority of authors who subsequently referred to the language, two American linguists have recently broken with this tradition by forwarding suggestions of possible affiliations. Greenberg[6] classified "Shirianá" as a distinct group belonging to the "*Chibchan proper*," subfamily of the "*Macro-Chibchan*" family, and Swadesh[7] established a "*Macro-Sirionó*" with an internal separation of 30 mc, including Chapacura (27 mc), and Sirionó (21 mc). He later suggested (personal communication) that Waraoan should also be reckoned in "*Macro-Sirionó*," which would increase the internal divergence of this microphylum to that of 72 mc. Since the latter suggestion is of major interest to the distribution of the Diego antigen, we shall return to the discussion of the same after having presented the material on the Waica blood groups.

Cultural aspects. The Yanoama are a semi-nomadic forest people who rely for their subsistence chiefly on hunting, gathering, and arboriculture. Fishing is of a very subordinate importance and only peripheral groups, such as the northern Sanumá, have adopted agriculture from neighboring tribes. Although arboriculture is of vital importance among most of the Yanoama subtribes (plantains [*Musa paradisiaca normalis*], and pupunha [*Guilielma gasipaes*]), there can be little doubt that the basic economic and cultural pattern of the Yanoama has remained essentially on a Paleo-Indian culture level of the early hunting peoples of South America.

Yanoama technology is very little developed. The Waica produce thick-walled conical cooking pots, and Yanoama women make large twined carrying baskets. Cordage, belts, and one type of hammock are made of planted cotton, but weaving and metal work of any kind is unknown. Recently, several Yanoama groups have learned how to make dugout canoes, but their crafts and paddles still lack the perfection of the same artifacts among their masters (e.g. Caribs). Very long bows and arrows are the main weapons of these Indians, but stick-clubs may antedate the former.[8]

The local groups of the Yanoama are composed of bands of several extended families with nuclear family households. Residence rules have, as yet, not clearly been established, but judging from the Sanumá of the Erebato and from the

5 Koch-Grünberg, 1913, pp. 493-498.
6 Greenberg, 1956.
7 Swadesh, 1959, p. 28.
8 Only the Waica were reported to make pottery, and the planting of cotton is very recent.

Waica,[9] there seems to be a strong tendency towards bilocality. Although bilocal extended families are relatively rare,[10] their existence among the semi-nomadic Yanoama could very well be possible, since there do not exist any decisive economic factors which could strongly favor unilocal residence. Among the Sanemá of the Cuura (incipient agriculturists) we have observed initial matrilocal with subsequent patrilocal residence and a rather formal initiation of common residence of the spouses. Polygyny is permitted and young girls are frequently married to men even before their first menstruation. The kinship system is of the Hawaiian type.

Local groups follow the suggestions of a headman in peacetime and receive orders from a war chief in wartime. There appear to exist at least two and possibly three different religious-medical practitioners among some of the subtribes, who (*hïwïawan*) represent their community at the court of a deified Culture Hero, who (*sabli*) regulate the groups' relationship to a host of animal and plant spirits, and who (*kïïlala*) cure physical ailments of mainly non-supernatural origin.[11] The *sabli* (shabolïwa) seems to be the most important practitioner of the Waica, among whom the *hïwïawan* has not been observed.

Physical appearance. Two authors have recently reported on the occurrence of a great phenotypical variation among the Sanemá (Samatari)[12] and among the Waica.[13] They mention four different types with more or less specific physical features:

a. A minority pygmoid type with a general stature of less than 130 cm, light skin, fine-cut faces with a gay expression, small hands and small feet.
b. Relatively tall type, dark skinned, robust, stout, and with a wild facial expression.
c. Type of medium stature, round-headed, with a feminine expression, small nose, small mouth, and yellowish clay-colored skin. Some individuals have wavy hair and brown instead of black eyes.
d. "Mongoloid" and "semi-Tartaric" type with almond-shaped eyes, frowning expression, protruding forehead and pointed chin, thin beard, slim, and of medium stature.

We shall return to this observation in a later chapter.

9 Barker, 1953, p. 478.
10 Murdock, 1949, p. 33.
11 Wilbert, 1981a.
12 Vinal, 1934, pp. 124-125.
13 Zerries, 1939.

BLOOD GROUP ANTIGEN TESTS

BLOOD GROUP STUDIES

The Material

Blood samples were taken from 142 less closely related individuals living in six settlements situated along the banks of the upper Orinoco and Mavaca rivers in the Territorio Amazonas of southern Venezuela. We started to take samples at the Mission of Boca del Ocamo and continued along the Orinoco until we reached the confluence with the Mavaca River and then continued up the Mavaca until we arrived at the settlements called Boca Mavaca and Laguna Mavaca.

The blood samples were analyzed for the following antibodies:

(1) anti-A, anti-A_1, and anti-B for the A_1 A_2 BO system
(2) anti-M, anti-N, anti-S, and anti-s for the MNSs systems
(3) Anti-P_1 (previously called anti-P), and anti-P, anti-P_1 (previously called anti-Tj^a) for the P system
(4) anti-D, anti-C, anti-c, anti-E, anti-e, and anti-$hr^{'rh}$ for the Rh system
(5) anti-Lu^a for the Lutheran system
(6) anti-K and anti-k for the Kell system
(7) anti-Le^a for the Lewis system
(8) anti-Fy^a for the Duffy system. Anti-Fy^b was only used in cases Fy ($^{a-}$)
(9) anti-Jk^a and Jk^b for the Kidd system
(10) anti-Di^a for the Diego system

Electrophoretic studies of the hemoglobins and haptoglobins were performed by Dr Tulio Arends who will report the results separately.

Results

A_1A_2BO: All samples were group O as was expected, because of the recency of contact with White and Negro.

MNSs: The gene M showed a high frequency (79%) as is usual for the majority of Indian tribes. The gene S was relatively low (19%) travelling mostly with the gene M.

Rh: The outstanding finding in this system was the high frequency of the chromosome R_o (DCE), (18%), and the low frequency of the chromosome R_2 (DcE), (6%), of which no homozygous sample was found; the frequency was deduced from the phenotype samples DCcEe. As expected, all cases were Rho(±) and no sample was found in which the presence of the chromosomes r or Ro could be presumed. Absence of the rh^s was observed in all

13a Shapiro, 1960.

Table 1

Frequency of blood group antigens in Waica Indians

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Phenotypes						Genes or chromosomes	
Observed			Expected		χ^2		
Absolute Number	Frequency %		Frequency %	Absolute Number			%
A_1A_2BO system							
A_1	0.	0.00					
A_2	0.	0.00					
B	0.	0.00					
O	141	100.00					
MNSs system							
MMSS	1	0.71	1.63	2.30	0.15		
MMSs	27	19.15	16.84	23.74		MS	12.76
MMss	62	43.97	43.52	61.36	0.01		
MNSS	1	0.71	1.54	2.17	0.04		
MNSs	17	12.06	11.85	16.71		Ms	65.97
MNss	24	17.02	20.09	28.33	0.66		
NNSS	1	0.71	0.37	0.52	0.25	NS	6.04
NNSs	3	2.13	1.84	2.59		Ns	15.23
NNss	5	3.54	2.32	3.27	0.91		
	141	100.00	100.00	140.99	2.02		100.00
					n = 5		
					0.90>P>0.80		
Rh system*							
DCCEE	6	4.26	3.40	4.79	0.06	DCE	18.44
DCCEe	36	25.52	27.72	39.09			
DCCee	81	57.45	56.51	79.68	0.02	DCe	75.17
DCcEE	4	2.84	2.36	3.32	0.08		
DCcEe	14	9.93	9.60	13.54			
DCcee	0	0.00	0.00	0.00		DcE	6.39
DccEE	0	0.00	0.41	0.58	0.58		
DccEe	0	0.00	0.00	0.00			
Dccee	0	0.00	0.00	0.00			
	141	100.00	100.00	141.00	0.76		
					n = 3		
					0.70>P>0.50		

* Six samples of the phenotype DCCEE, four samples DCcEE, and one sample DCcEe were not agglutinated with anti-e[6].

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TABLE 1 (cont'd)

Frequency of blood group antigens in Waica Indians

Phenotypes	Observed Absolute Number	Observed Frequency %	Expected Frequency %	Expected Absolute Number	x^2	Genes or chromosomes	%
P system							
P_1	81	57.45	–	–	–		34.77
P_2	60	42.55	–	–	–		65.23
p	0	0.00					0.00
	141	100.00					100.00
Duffy system							
Fy(a+)	117	82.98				Fy^a	58.73
Fy(a—)	24	17.02				Fy^b	41.25
	141	100.00					
Kell system							
KK	0	0.00	–	–	–	K	0.00
Kk	0	0.00	–	–	–		
kk	141	100.00	–	–	–	k	100.00
Lewis system							
Le(a+)	0	0.00					
Le(a—)	141	100.00					
Kidd system							
Jk(a+b—)	34	24.11	31.39	44.26	2.38		
Jk(a+b+)	90	63.83	49.28	69.48	6.06	Jk^a	56.03
Jk(a—b+)	17	12.06	19.33	27.26	3.86	Jk^b	43.97
	141	100.00	100.00	141.00	12.30		100.00
					>P>0.001		
Diego system							
Di(a+)	0	0.00					
Di(a—)	141	100.00				Di^a	0.00
						Di	100.00

phenotype samples but one of which failed to react with the common anti-e. The absence of the chromosome Dce and dce and the high frequency of the chromosome DCE is apparently against the crossing-over hypothesis of Fisher[14] which presumes that the occasional crossing-over of the high fre-

[14] Race and Sanger, 1950.

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quency chromosomes DCe and DcE in Indians could maintain the low frequency of the chromosomes Dce or dce and DCE.

P: As in all South American tribes the gene P_1 was below 40%.

Lutheran, Kell and *Lewis:* All cases were Lu (a—), K (—) and Le (a—) confirming the lack of admixture with White and Negro populations.

Duffy: Twenty four samples were Fy(a—) but all of them were agglutinated by anti-Fy^b, ruling out the presence of the gene Fy. The Fy^a frequency, although low (38%), is on the range found in other South American aborigines.[16]

Kidd: The Jk^a frequency (56%) is on the usual range observed in American Indians.

Diego: All samples were Di(a—). We will comment fully on this finding in the discussion.

Frequency of Antigens of the Ten Blood Group Systems in Marginal Tribes

Tribes on a Paleo/Meso-Indian level of culture development have conventionally been designated by the term "Marginals." Physical anthropologists[18] have called *Marginal American Indians* such groups who are predominantly dolichocephalic, somewhat Mongoloid, and predominantly non-agricultural.

So far we have analyzed three of the above defined Marginal tribes: the Warao,[17] the Yaruro,[18] and the Waica. Comparing the blood group antigens tested in these tribes, we found the following results in each blood group system:

ABO: As had been expected of almost isolated tribes, all individuals tested were group O.

MNSs: The Warao were aberrant, showing a very low frequency of M (42%), as compared with Yaruro (78%) and Waica (79%). The Ss antigens were tested only in Yaruro and Waica, showing similar results.

P: This system was tested only in Yaruro and Waica which showed low frequencies of the gene P_1 (38% and 35% respectively), as is observed in the majority of South American Indians.

Rh: They showed a similar frequency for the chromosome R_1 (DCe), ranging from 63% to 78%, but the frequencies of the R_2 (DcE) and R_0 (DCE) were quite different. While at R_2 the Waica were aberrant in showing only 0%, the Yaruro and Warao showed 26% and 27% respectively; at R_0 the aberrants were the Yaruro who lacked this chromosome while the Warao and Waica had an incidence of 3% and 18% respectively.

15 Layrisse, Layrisse, and Wilbert, 1960, 1961; Layrisse, Layrisse, Garcia, and Wilbert, 1961.
16 Coon, Garn, and Birdsell, 1950.
17 Layrisse, Arends, and Wilbert, 1958.
18 Layrisse, Layrisse, Garcia, and Wilbert, 1961.

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Duffy: The Fy (a+) ranged in these tribes from 77% to 92%, which is the usual range found in Indian tribes. 143

Kidd: The gene Jk^a showed comparable results in Yaruro 49% and in Waica 56%. The Warao were not tested for this gene.

Diego: As was mentioned before, the Waica showed absence of the gene Di^a; the Warao had a negative frequency among the Winikina sub-tribe and 1.9% among the Guayo sub-tribe; the Yaruro showed five Diego-positive cases out of 102 samples, but four of them were derived from eleven samples taken from a single band. For reasons mentioned elsewhere, the authors suggested that the Warao as well as the Yaruro were originally Diego-negative, and that their low Di^a frequencies are due to admixture with neighboring tribes exhibiting a relatively high frequency of the gene.

Other Blood Groups

The tribes tested for Lutheran, Kell, and Lewis showed negative frequency for Lu^a, K, and Le^a, as is seen also in other Indian tribes with non-Indian admixture.

As can be gathered from these comparisons, it is mainly on the basis of the Di^a gene that we could establish a sharply contrasting difference between the Marginal tribes and other South American tribes tested so far (Goajiro 8%, Paraujano 10%, Munduruku 12%, Guahibo 14%, Caingang 17-46%, Aymara 17%, Caribe [Cariña 29%, Pemon 28%, Yupa 27%]), etc. . .

DISCUSSION

In a previous section we have tried to indicate that the absence or a very low frequency of the Diego gene appears to coincide with a culture pattern typical for hunting, fishing and gathering tribes of South America. On several other occasions[19] it has been pointed out as well that there seems to exist a coincidence of certain levels of cultural developments with characteristic ranges of Diego frequencies, and that these frequencies tend to be quantitatively similar or identical between tribes of "genetic" linguistic affiliation, in the sense Greenberg[20] uses the term. For Venezuela we have, in particular, made mention of the low frequency or absence of the Diego gene among the Waica, Warao, and Yaruro who exhibit a Marginal or Paleo/Meso-Indian type of culture. 143 114 104

We have also indicated that this parallel occurrence of Diego gene distribution and the culture pattern of its bearers coincides to a certain extent with a similar

19 Layrisse and Wilbert, 1960.
20 Greenberg, 1959.

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classification, based on somatological and phenotypical characteristics of the American Indians as proposed by Coon, Garn, and Birdsell,[21] who distinguished between dolicephalic and somewhat mongoloid *Marginal American Indians*, and broader headed less mongoloid *Central American Indians. As a parallel and, of course, not as a causal phenomenon*, the cited authors (very much like the present authors) record that the *Marginal American Indians* include largely non-agricultural Indians of the Americas, while the latter are agricultural peoples of North and South America, especially of the central part. This observation receives substantial support from the recorded facts of the Diego gene distribution, and its importance for migration theory and culture history of South America may be significant. In the given frame of the present paper we shall restrict ourselves to the discussion of the importance of the absence of the Diego gene mainly among two Marginal tribes of Venezuela, the Waica and the Warao, trying to indicate a possible direction for future Diego research.[21a]

In a recent study, Canals Frau [22] observed that the oldest stratum of *Homo sapiens* in America was composed of five distinct racial types, i.e., the *Silvidos*, the *Sonóridos*, the *Láguidos*, the *Patagónidos*, and the *Huárpidos*, and that the last three were of South American distribution. It is interesting to recall in this connection that Canals Frau includes the Waica and the Piaroa in this antique stratum within which great phenotypical variation has been observed by Vinci, for the Yanoama, and by Baumgartner for the Piaroa.[23] It would seem that the actual occurrence of this variation in one and the same group could best be interpreted by fusion and interbreeding of the different racial types of Paleo-American Man.

Because of his early appearance, the culture of this Paleo-American Man will necessarily have been on a Paleo-Indian (hunters), and later Meso- Indian (fishermen) level of development.[24] Kirchhoff,[25] in referring to the hunting and fishing Marginals of Venezuela, observed that the "differences in subsistence are correlated with other cultural differences, indicating that there was not one basic culture type, but two, the Hunting Culture and the Fishing Culture;" that "Each in turn was divided into at least two subtypes," and that "Without further comparative research, it is impossible to say whether these subtypes were simply local variants of the two basic types or whether they too sprang from different origins."

21 Coon, Garn, and Birdsell, 1950.
21a Layrisse and Wilbert, 1961.
22 Canals Frau, 1959.
23 Vinci, 1956; Zawisa, 1959; Baumgartner, 1954.
24 Cf. Bennett, 1948.
25 Kirchhoff, 1948, p. 443.

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The most typical representative of the Hunters among modern Venezuelan Indians are the Yanoama, while the most typical example of a people of Fishermen culture can be seen in the Warao. It is interesting for the discussion of Kirchhoff's problem that Swadesh (personal communication) suggests a linguistic affiliation between Yanoaman and Waraoan; interesting, because it is generally accepted that "genetic" linguistic relationship is most likely to have biological significance, since the ancestors of the speakers of genetically related languages[26] once belonged to the same gene pool.

In following up Swadesh's suggestion, the present authors have compared (a) the basic vocabularies of Yanoaman and Waraoan, and (b) all available pairs of about 1000 Yanoama (Sanemá) words with their equivalents in the Warao dictionary recently published by Barral.[27] As a result of this comparison, more than twenty percent of the total pairs compared appeared to be cognate; a percentage certainly high enough to encourage further research. A preliminary glottochronological calculation resulted in 43 mc of separation, which corresponds to twenty six percent of common retentions. Accepting this result as a strong *prima facie* case, it would suggest that the *Yanoama* and *Warao* originally united, separated from each other some 4,500 years ago.[28]

If we compare the blood group phenotype frequencies found in these two tribes, we see that only the frequencies at Diego are very similar, whereas MN, Rh, and Duffy showed statistically significant variations. It is generally accepted that significant differences of gene frequencies in two populations are indicative of different origin, but in comparing small isolated populations, such as most Indian tribes, this statement may not be applicable without allowing for certain restrictions. The gene frequencies in these populations may, for instance, reflect the fortuitous results of gene drift, since in a population with an effective size of 200, an allele would require a selective advantage of 0.01 to avoid the action of drift.[29]

In our case, we are comparing the gene frequencies of blood groups, the majority of which have, until now, been considered to be of neutral selective value. Although the Waica and the Warao belong to the most numerous Indian tribes of Venezuela and lowland South America (8-10,000), they have been living in smaller isolated groups which might have favored the production of gene drift. On this basis, then, one could consider gene drift as the most probable explanation for the phenotype differences of the Rh, MN, and Duffy systems, especially, if we take into consideration a possible 4,500 years lapse of time since their separation.

26 Greenberg, 1953.
27 Barral, 1957.
28 Wilbert, 1961b.
29 Glass, Sacks, Jahn, and Hess, 1952.

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We would best interpret our general culture historic problem in the sense of suggesting that there exists a high probability for the two different populations and culture types to represent simply variants of basically the same people and the same culture type. Archaeologists[20] have proved that the Meso-Indian culture type dates back to 4150 ± 80 BP (Manicuare), so that the *Warao* Meso-Indian culture type could actually date back to the time of their splitting off from the *Yanoama* who, for their part, continued to live in the Paleo-Indian tradition, and which, in turn, may date back to its most original form in Venezuela to 16,000 ± 300 BP and more.

In our particular case, then, the establishment of the genetic identity of two tribes with respect to the Diego blood gene has led us to assume that Paleo-American Man in Venezuela, although phenotypically different, is homogeneous for the Diego gene. Probably, in response to a changing environment, he developed two different culture types still traceable among his modern descendants. A detailed analysis of the contents of both cultures would greatly substantiate this hypothesis, but in the limited frame of the present paper we shall have to refrain from doing so.

In closing this discussion, we would like to underline the preliminary character of our hypothesis. The culture content of the Waica and of the Warao has not been fully described as yet; the linguistic affiliation of the two tribes remains to be confirmed by profound linguistic analysis; and genetically we have little more to go by than the behavior of mainly one gene. Nevertheless, taken together this kind of threefold evidence, in spite of all the existing limitations, appears to be much stronger than the single evidence available for any one of them, and it would be highly desirable to test similar cases along the lines described above.

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[20] Cruxent and Rouse, 1958-59, vol. 1, tables 2 and 3.

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